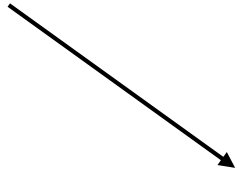


# BIOL 812

## Graphical Concepts

## Vector



Formats:

SVG

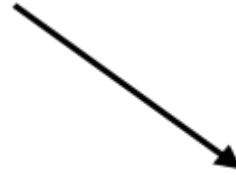
PDF

EPS

AI

PS

## Raster



Formats:

JPEG

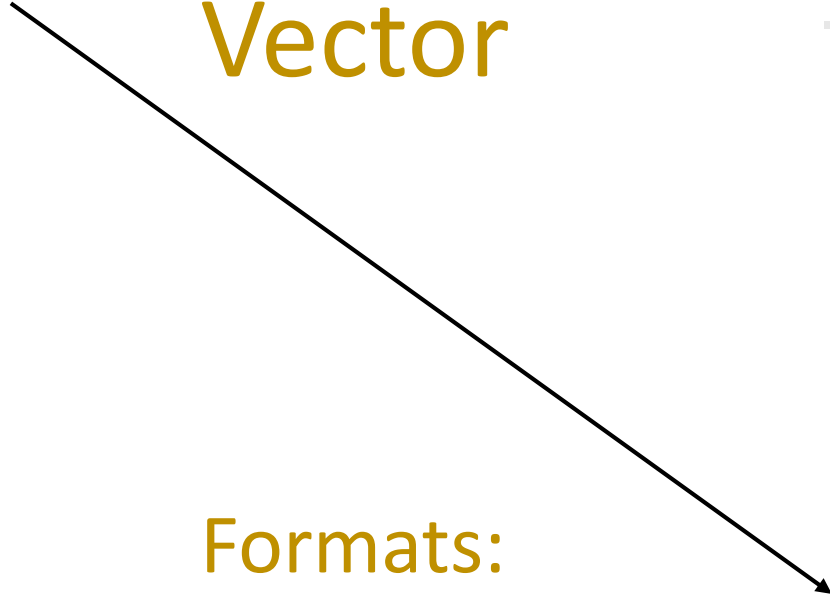
PNG

TIFF

BMP

# Vector vs. Raster Formats

Vector



Formats:

SVG

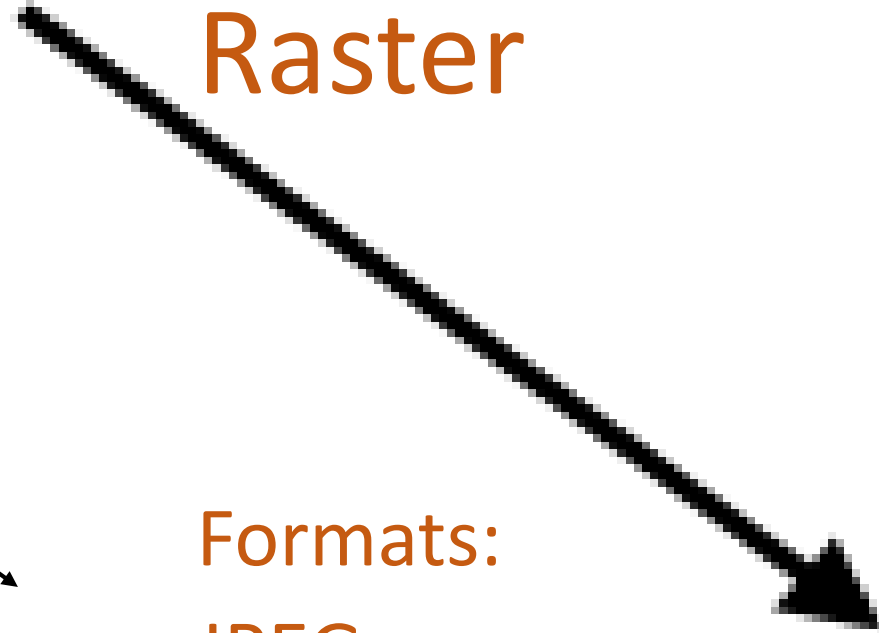
PDF

EPS

AI

PS

Raster



Formats:

JPEG

PNG

TIFF

BMP

Easy, no loss of information



Vector

Raster



Hard – which pixels to keep?

Pixel Dimension = Physical size x Resolution

Large size, low resolution



Small size, high resolution

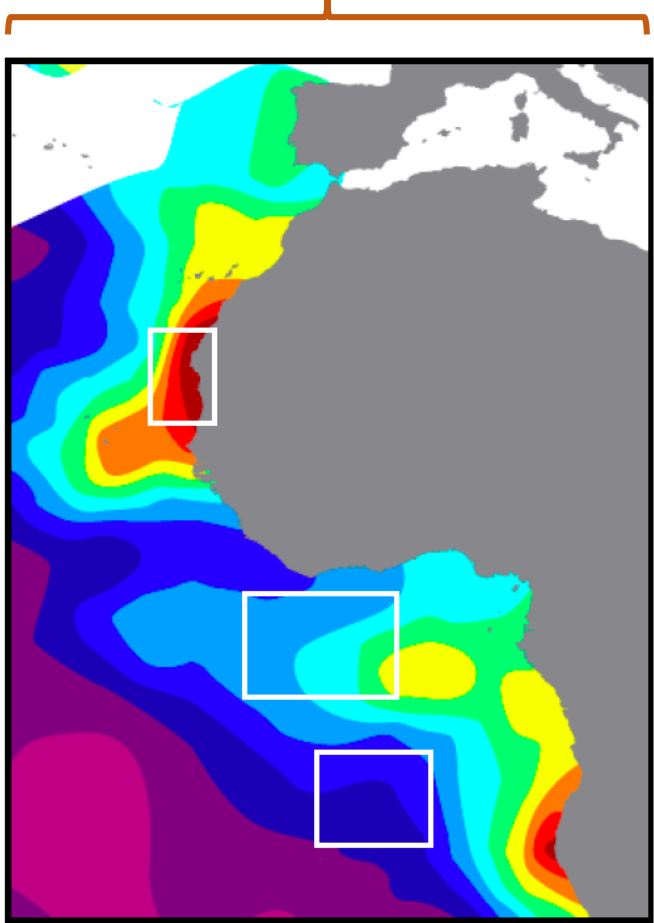


Same pixel dimension

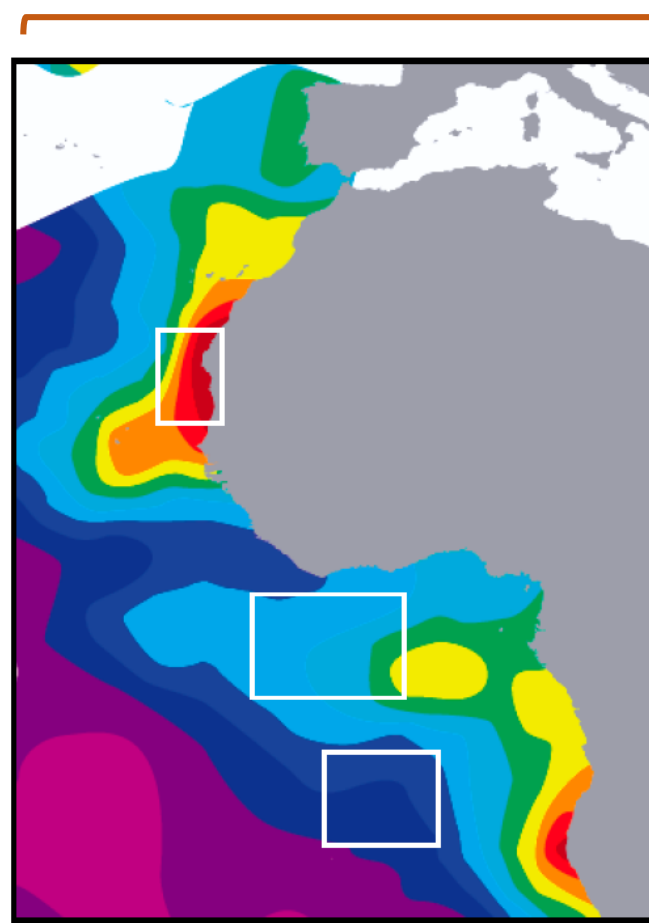
# RGB (screen) vs CMYK (print)

Screen

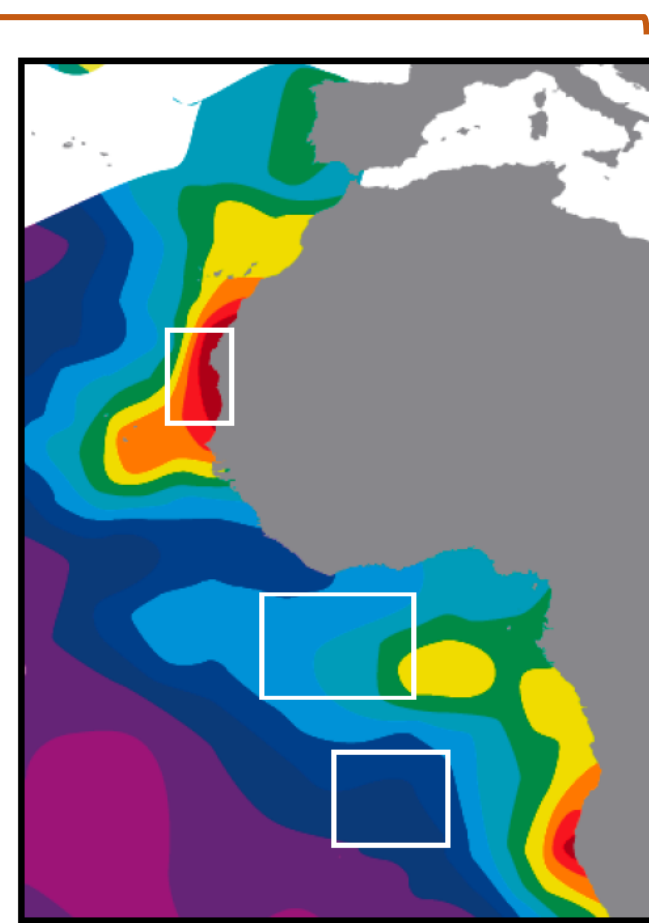
Print



RGB



CMYK  
Coated paper



CMYK  
Uncoated paper

## DON'T USE POWERPOINT FOR PUBLICATION

Advanced, expensive, steep learning curve:

- Adobe Photoshop (pixels)
- Adobe Illustrator (vectors)

FREE Software:

- GIMP (pixels) <http://www.gimp.org/>
- Inkscape (vectors) <https://inkscape.org/en/>

Bioconductor: bioinformatics tools in R

<http://www.bioconductor.org/packages/release/bioc/html/EImage.html>

EImage – R-based image processing

<http://www.bioconductor.org/packages/release/bioc/html/EImage.html>

Quick EImage intro tutorial:

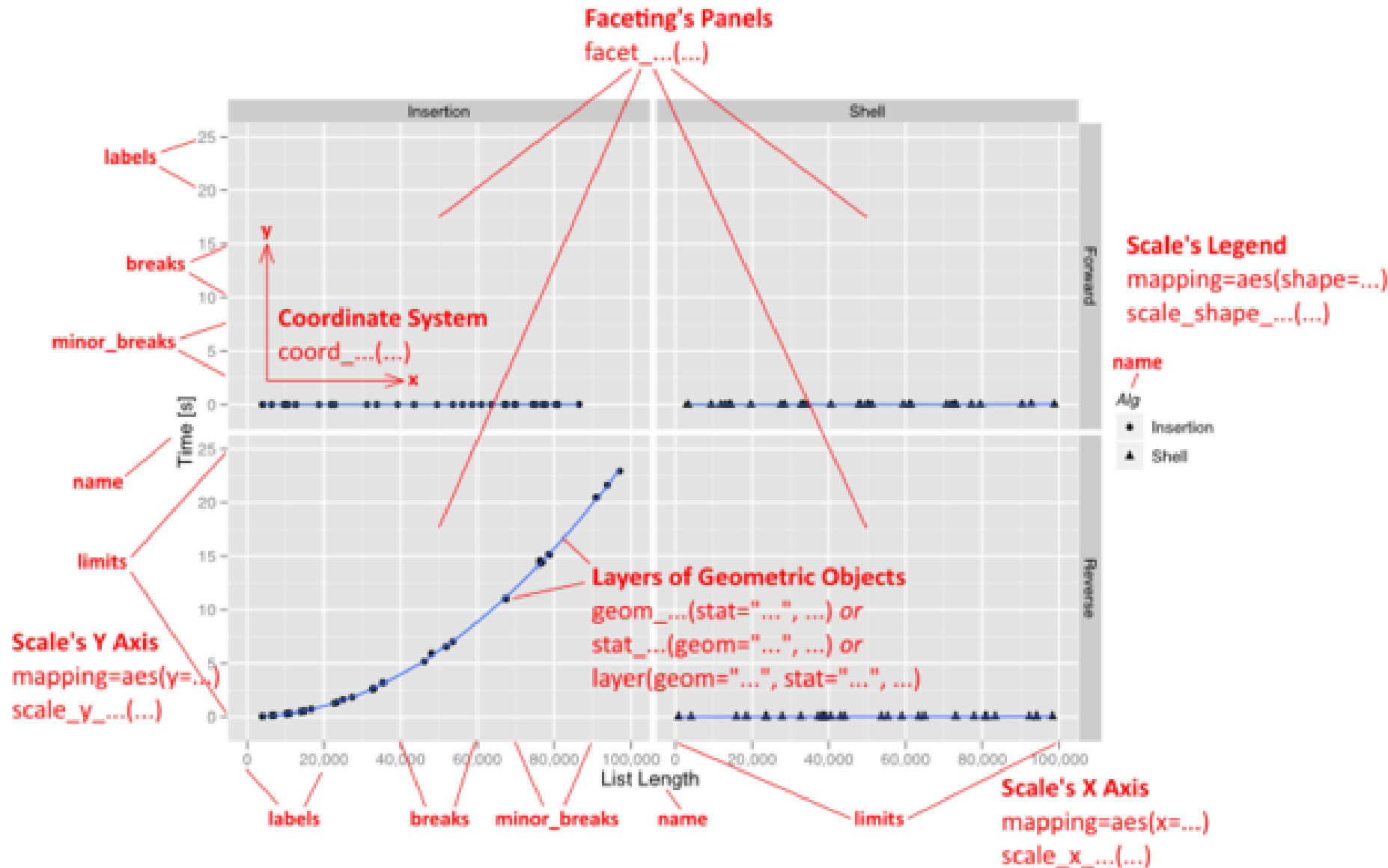
<http://www.bioconductor.org/packages/release/bioc/vignettes/EImage/inst/doc/EImage-introduction.pdf>

Full documentation:

<http://www.bioconductor.org/packages/release/bioc/manuals/EImage/man/EImage.pdf>



# Anatomy of a ggplot() plot

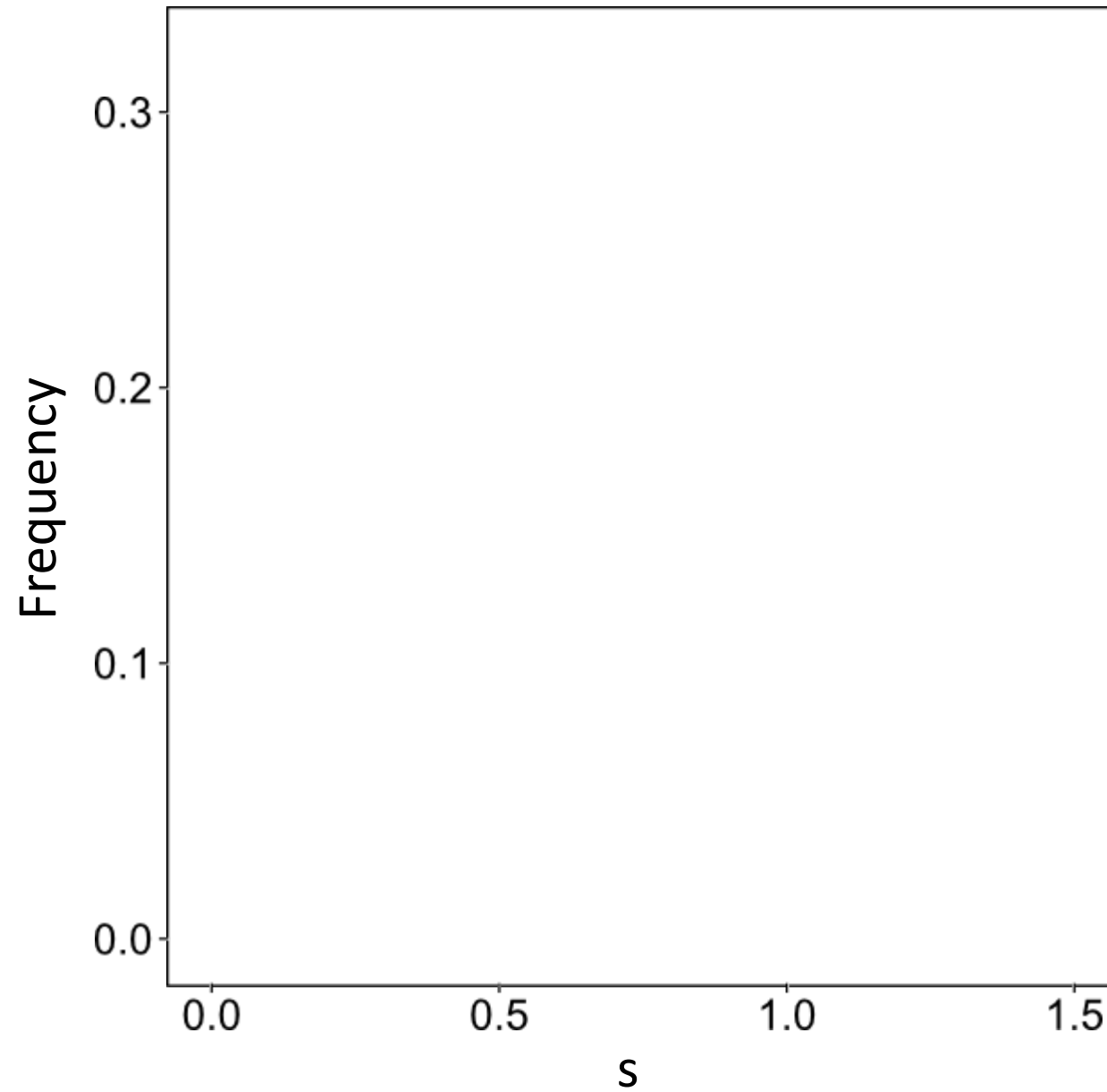


- data
  - any information you want to plot
- geoms
  - geometric objects (lines, points, polygons)
- stats
  - statistical transformations applied to the data (e.g. binning for histograms)
- scale
  - scales of conversion from data to visual space (e.g. legend, range and scale of axes)

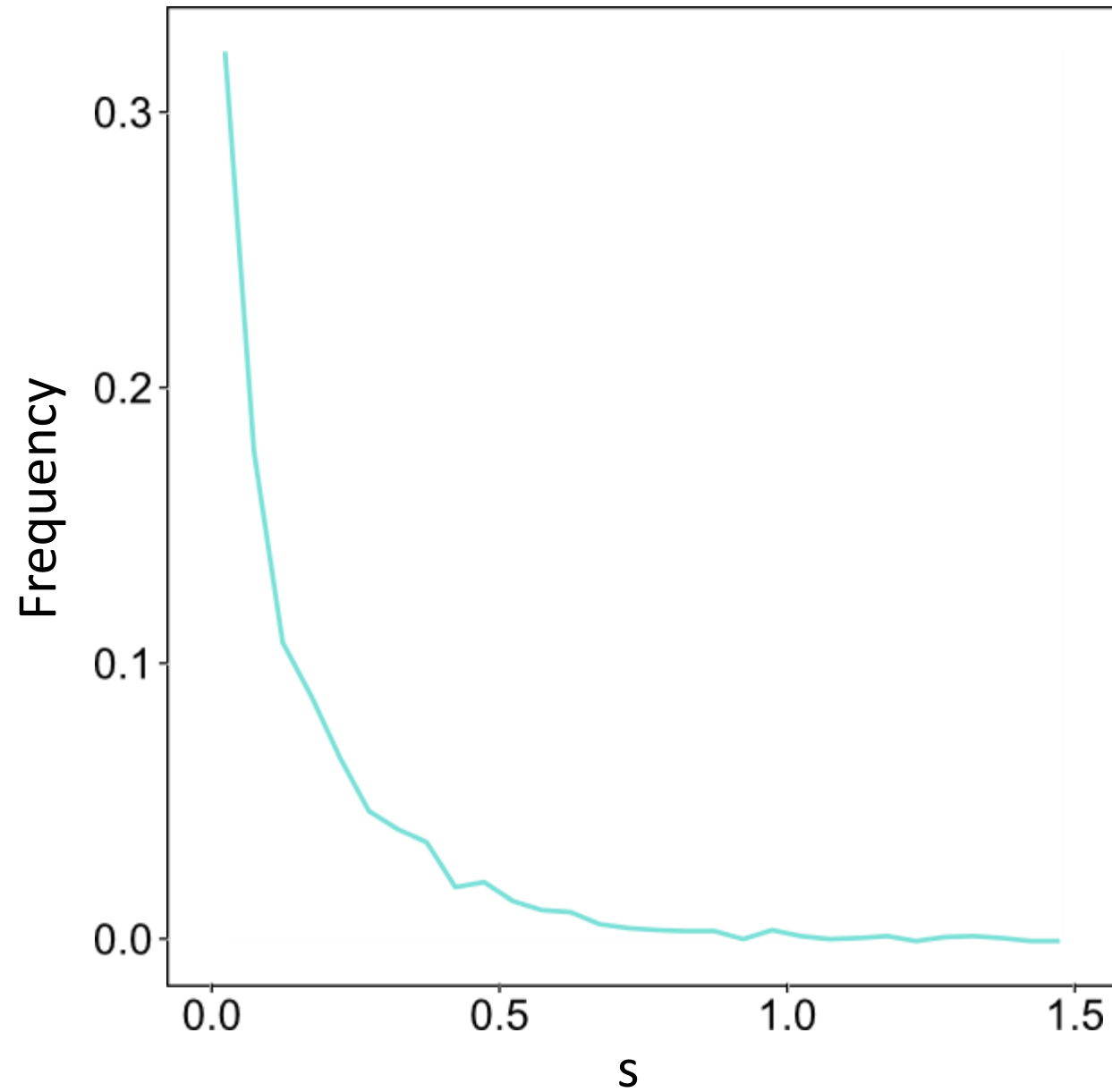
- coord
  - coordinate system of the graph (e.g. Cartesian, polar, lat/long)
- facet
  - break up data into separate graphs
- aes
  - aesthetic mapping describes how data is mapped (e.g. x, y, colour)
- theme
  - fine-tune appearance (e.g. background colour, gridlines)

# Build graphics as 'layers'

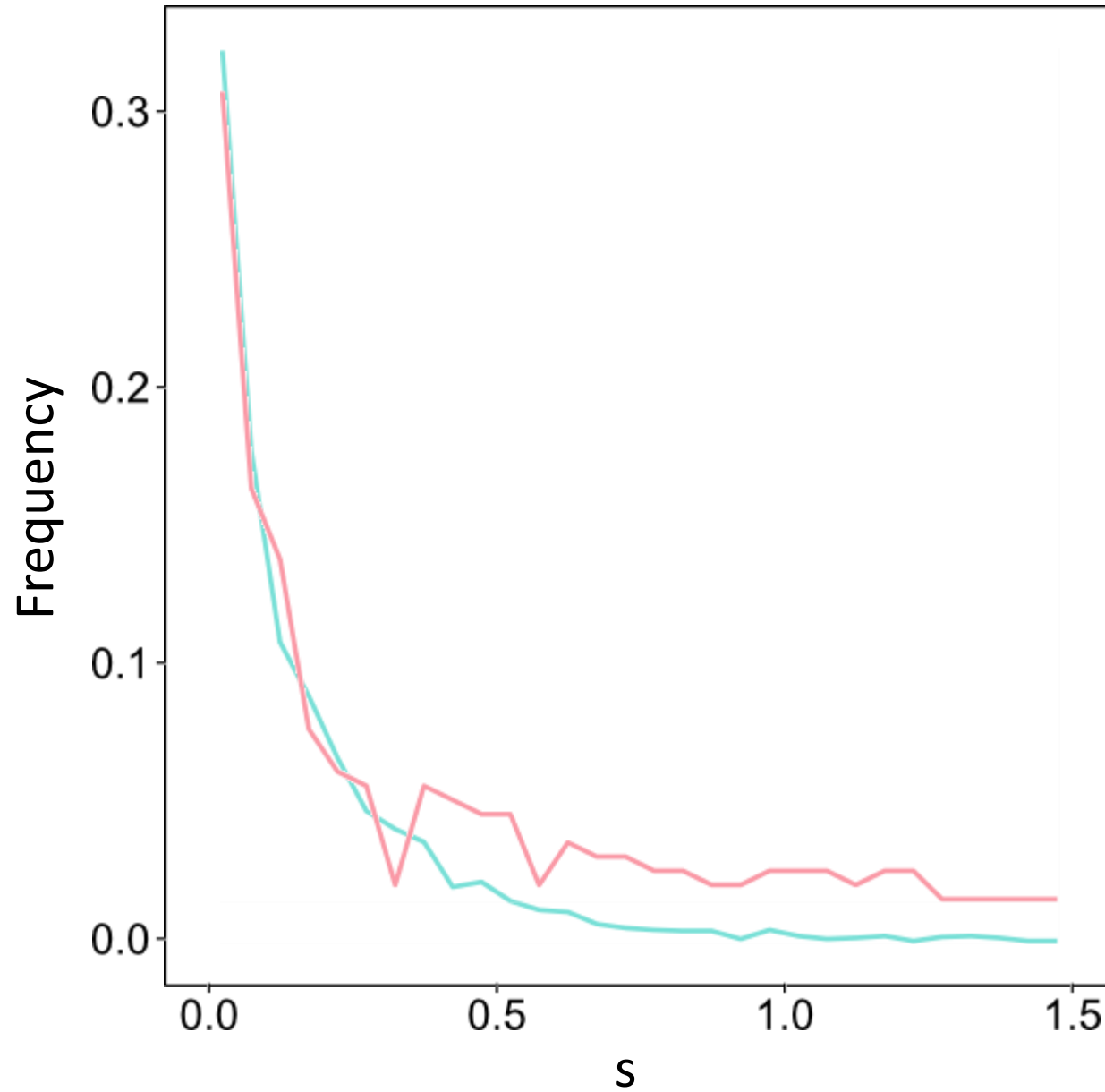
# Build graphics as layers in ggplot



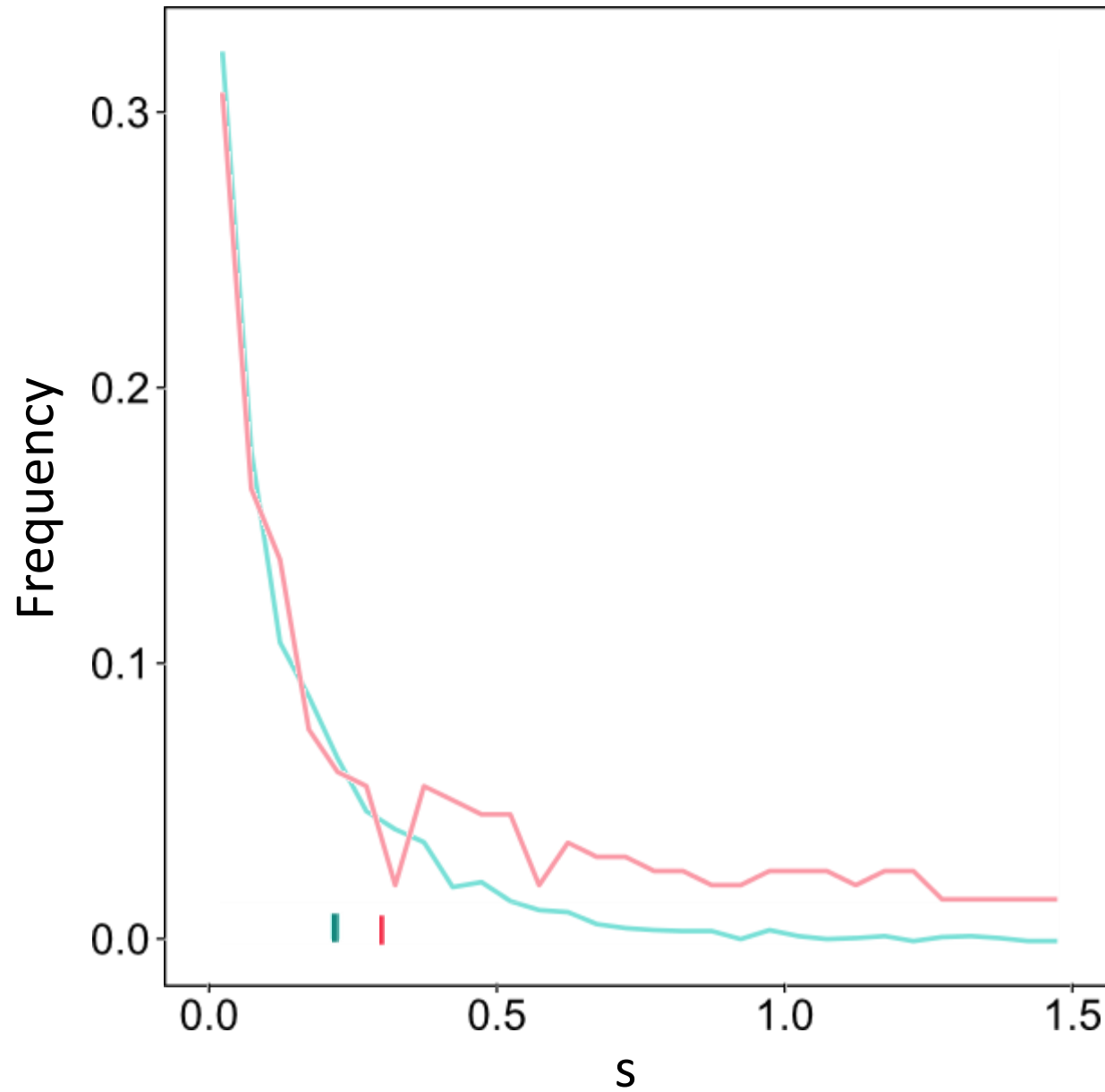
# Build graphics as layers in ggplot



# Build graphics as layers in ggplot

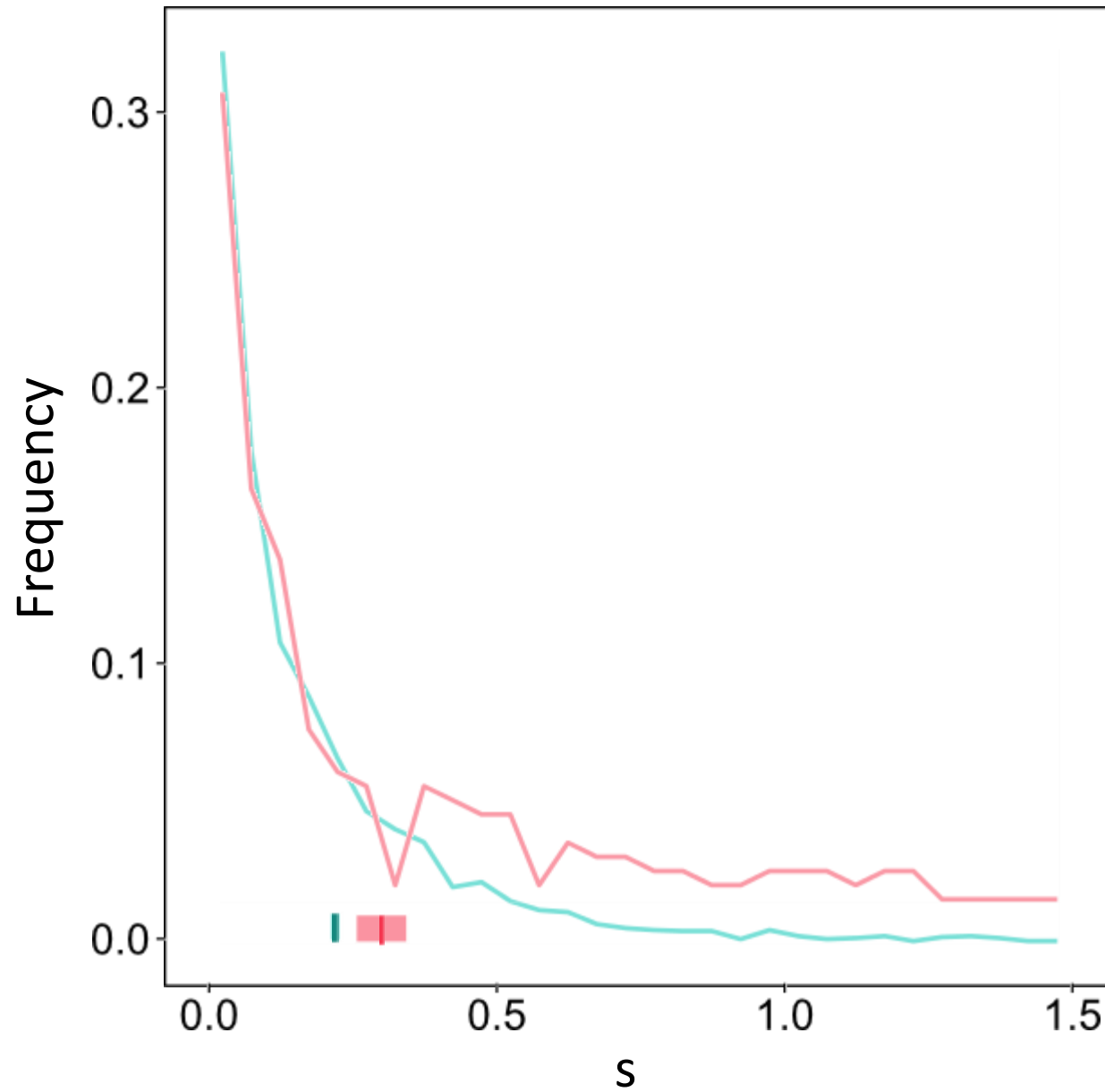


# Build graphics as layers in ggplot





# Build graphics as layers in ggplot



# Geom list

Name	Description
abline	Line, specified by slope and intercept
area	Area plots
bar	Bars, rectangles with bases on y-axis
blank	Blank, draws nothing
boxplot	Box and whiskers plot
contour	Display contours of a 3d surface in 2d
crossbar	Hollow bar with middle indicated by horizontal line
density	Display a smooth density estimate
density_2d	Contours from a 2d density estimate
errorbar	Error bars
histogram	Histogram
hline	Line, horizontal
interval	Base for all interval (range) geoms
jitter	Points, jittered to reduce overplotting
line	Connect observations, in ordered by x value
linerange	An interval represented by a vertical line
path	Connect observations, in original order
point	Points, as for a scatterplot
pointrange	An interval represented by a vertical line, with a point in the middle
polygon	Polygon, a filled path
quantile	Add quantile lines from a quantile regression
ribbon	Ribbons, y range with continuous x values
rug	Marginal rug plots
segment	Single line segments
smooth	Add a smoothed condition mean.
step	Connect observations by stairs
text	Textual annotations
tile	Tile plot as densely as possible, assuming that every tile is the same size.
vline	Line, vertical

Table 4.2.: Geoms in ggplot2

Name	Default stat	Aesthetics
abline	abline	colour, linetype, size
area	identity	colour, fill, linetype, size, <b>x, y</b>
bar	bin	colour, fill, linetype, size, weight, <b>x</b>
bin2d	bin2d	colour, fill, linetype, size, weight, <b>xmax, xmin, ymax, ymin</b>
blank	identity	
boxplot	boxplot	colour, fill, <b>lower, middle, size, upper, weight, x, ymax, ymin</b>
contour	contour	colour, linetype, size, weight, <b>x, y</b>
crossbar	identity	colour, fill, linetype, size, <b>x, y, ymax, ymin</b>
density	density	colour, fill, linetype, size, weight, <b>x, y</b>
density2d	density2d	colour, linetype, size, weight, <b>x, y</b>
errorbar	identity	colour, linetype, size, width, <b>x, ymax, ymin</b>
freqpoly	bin	colour, linetype, size
hex	binhex	colour, fill, size, <b>x, y</b>
histogram	bin	colour, fill, linetype, size, weight, <b>x</b>
hline	hline	colour, linetype, size
jitter	identity	colour, fill, shape, size, <b>x, y</b>
line	identity	colour, linetype, size, <b>x, y</b>
linerange	identity	colour, linetype, size, <b>x, ymax, ymin</b>
path	identity	colour, linetype, size, <b>x, y</b>
point	identity	colour, fill, shape, size, <b>x, y</b>
pointrange	identity	colour, fill, linetype, shape, size, <b>x, y, ymax, ymin</b>
polygon	identity	colour, fill, linetype, size, <b>x, y</b>
quantile	quantile	colour, linetype, size, weight, <b>x, y</b>
rect	identity	colour, fill, linetype, size, <b>xmax, xmin, ymax, ymin</b>
ribbon	identity	colour, fill, linetype, size, <b>x, ymax, ymin</b>
rug	identity	colour, linetype, size
segment	identity	colour, linetype, size, <b>x, xend, y, yend</b>
smooth	smooth	alpha, colour, fill, linetype, size, weight, <b>x, y</b>
step	identity	colour, linetype, size, <b>x, y</b>
text	identity	angle, colour, hjust, <b>label</b> , size, vjust, <b>x, y</b>
tile	identity	colour, fill, linetype, size, <b>x, y</b>
vline	vline	colour, linetype, size

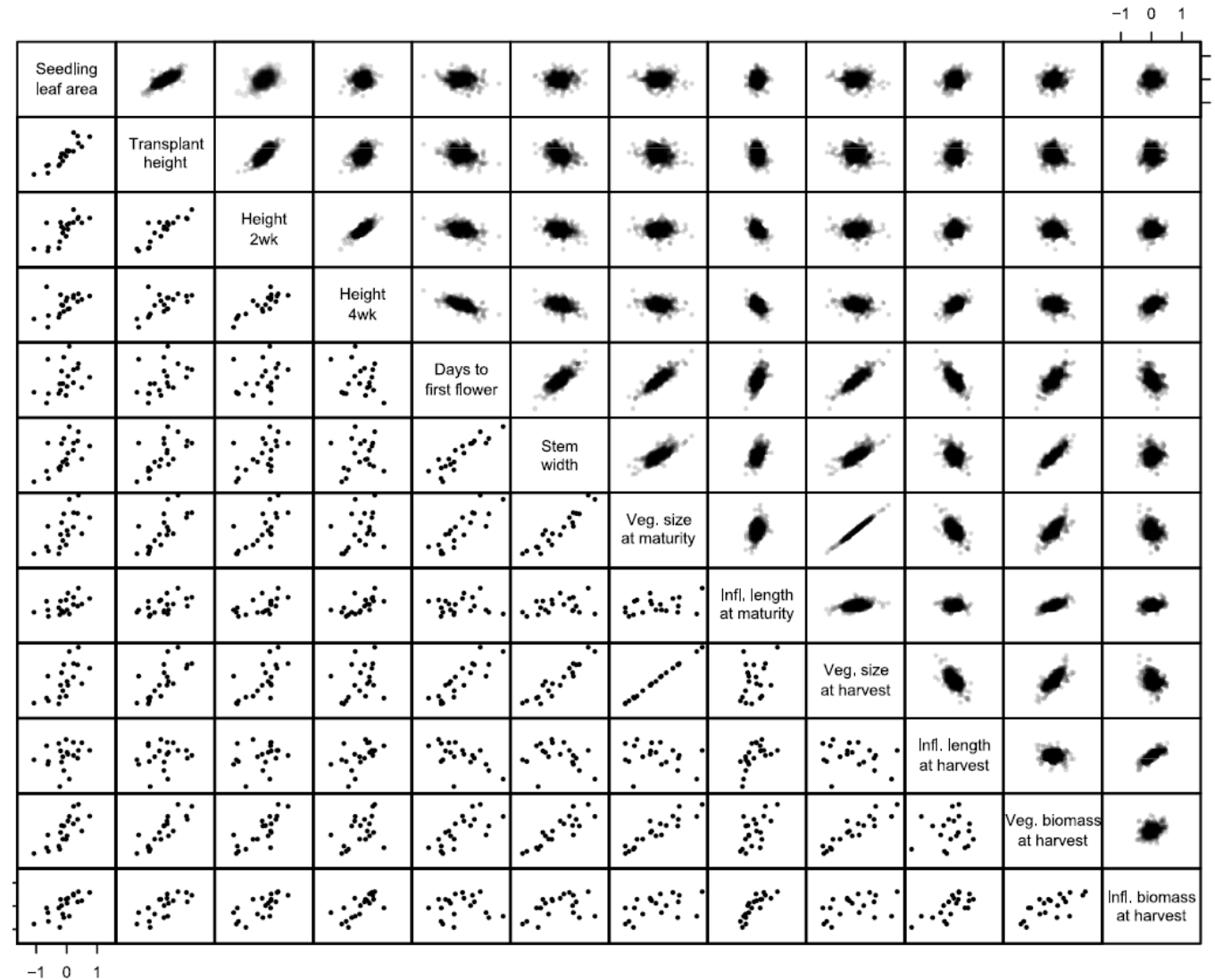
Table 4.3.: Default statistics and aesthetics. Emboldened aesthetics are required.

# R graphics inspiration

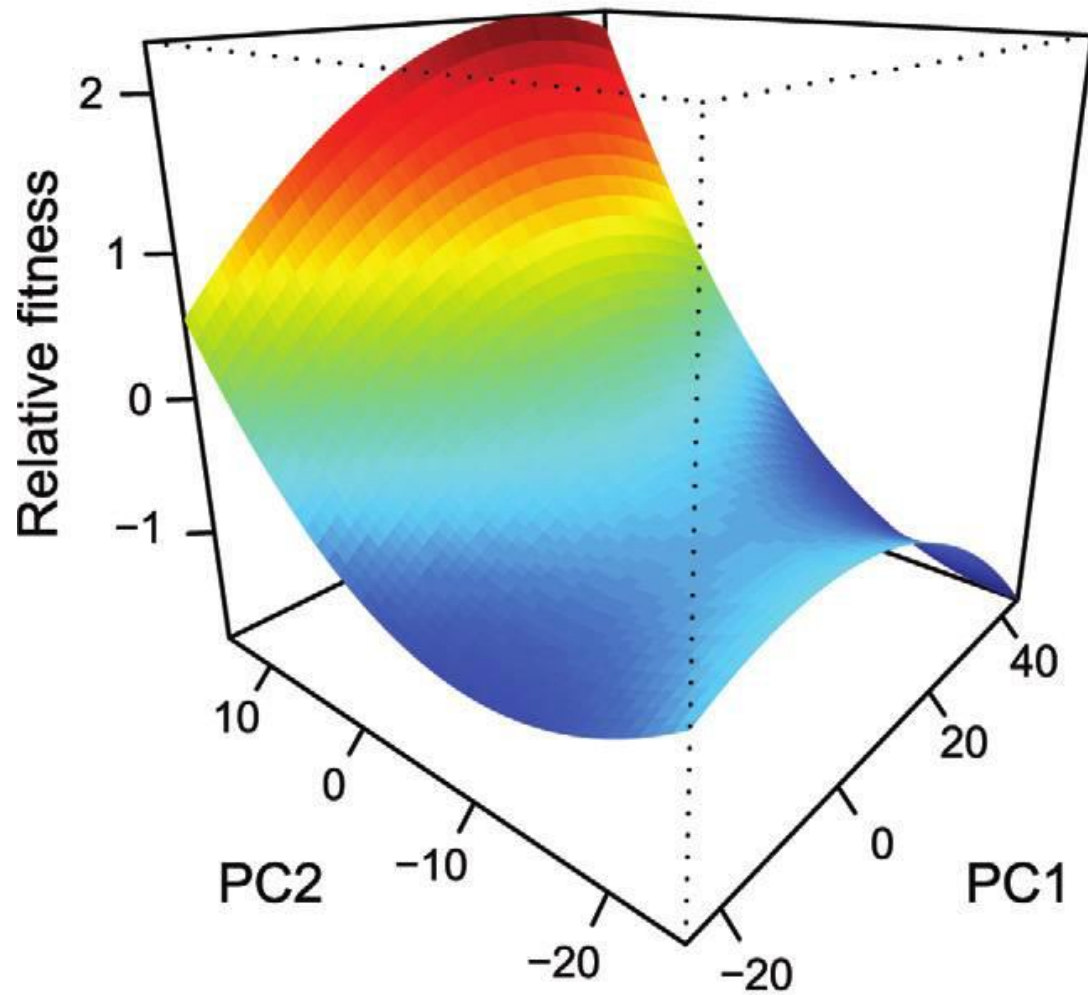


## Pairwise regressions

*lattice* package

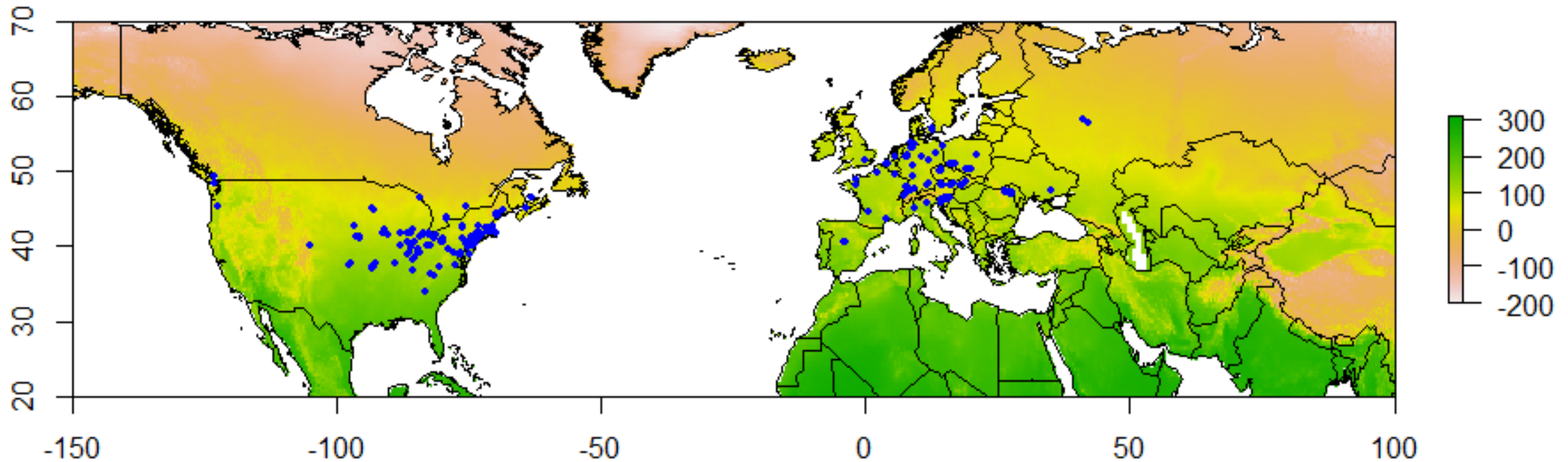


Plot of fitness (z axis) for two principal component traits (PC1 and PC2)



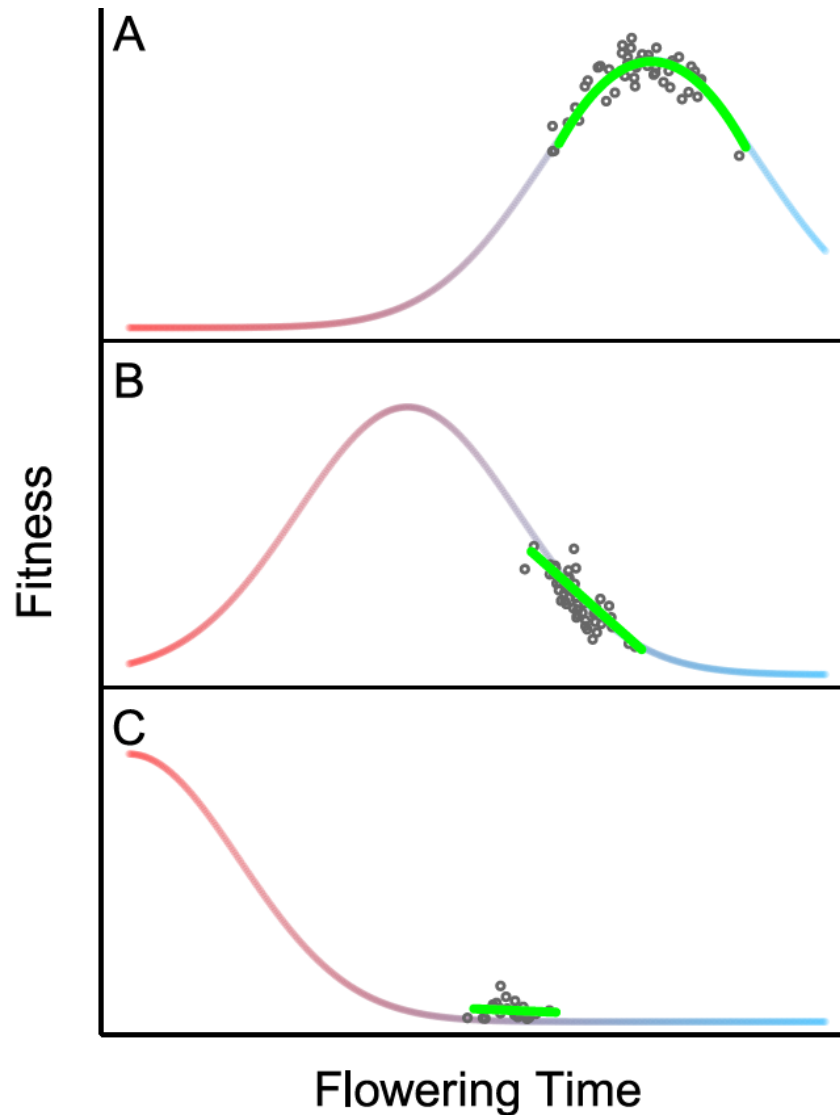
*persp()* function

World climate data (white, orange green) and sample sites (blue dots)  
from [garlicmustard.org](http://garlicmustard.org)



*dismo, raster, rgdal, maptools, leap* packages

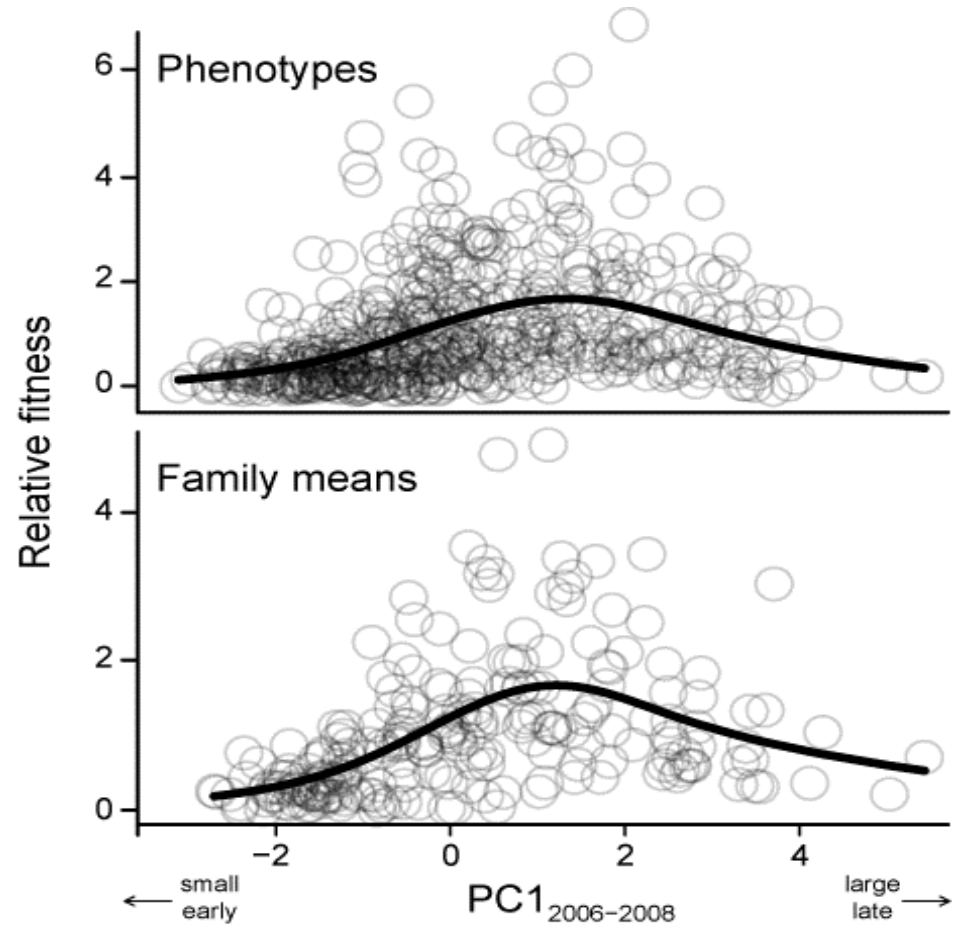
# Multi-panel simulation model



Fitness surfaces (smooth curves) with simulated genotypes (dots) and Lande-Arnold selection gradients (green curve)

*ggplot2* package

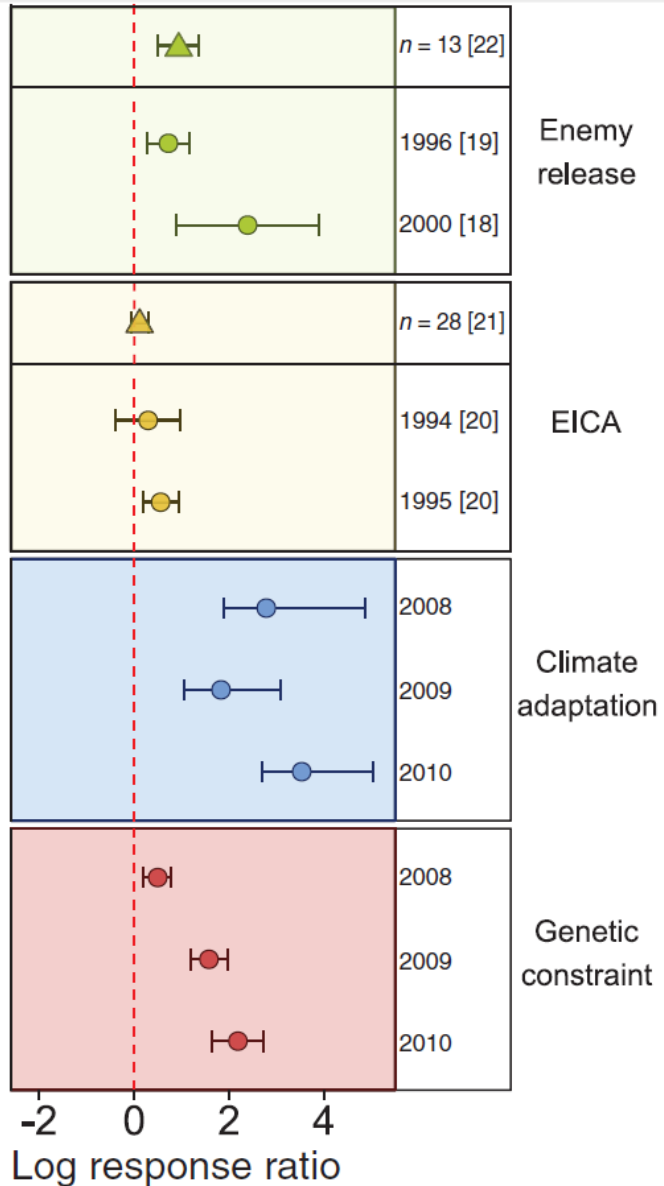
## Standard bivariate plot with `gam()` fit



*ggplot2* package



# Multi-panel plots of means + 95% C.I.

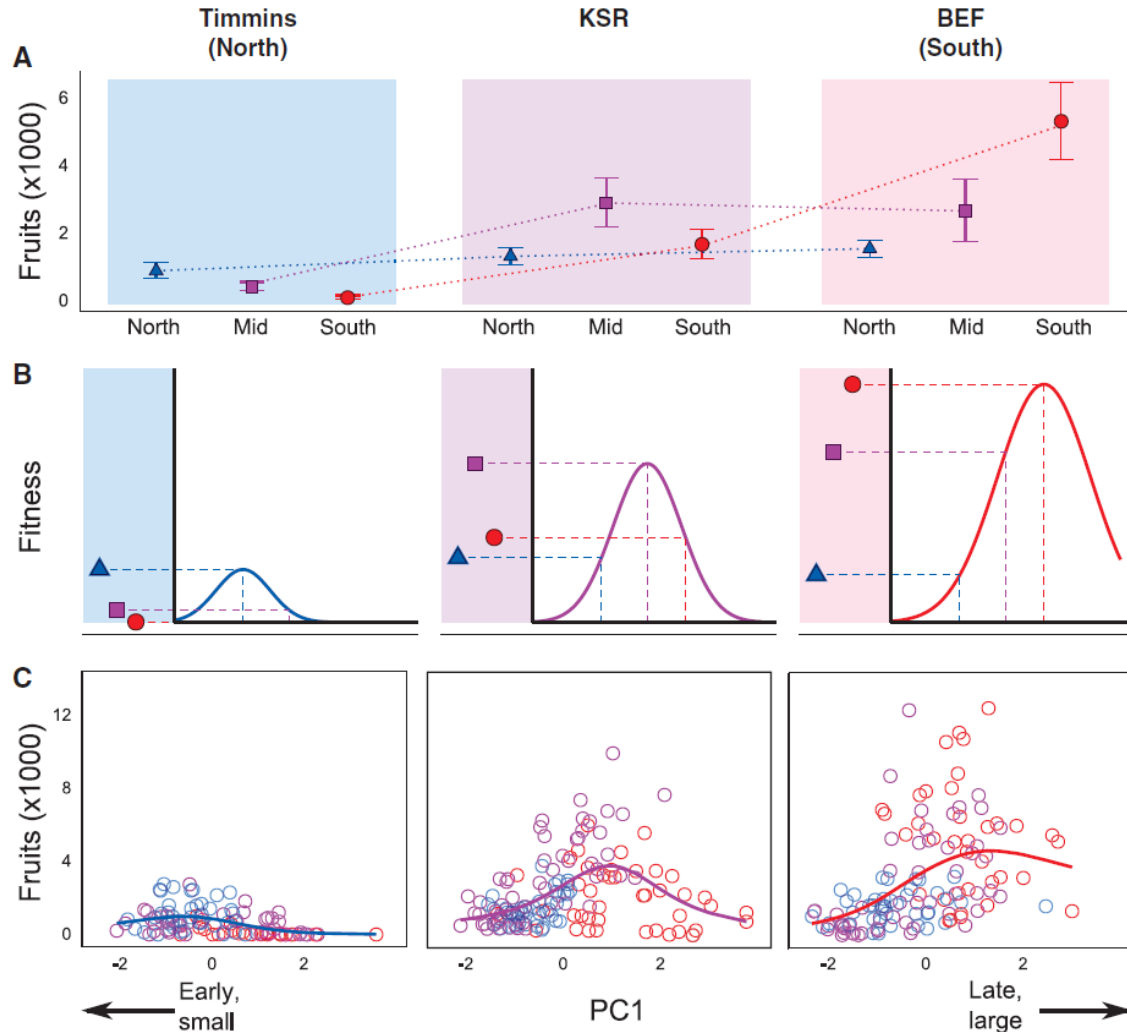


Standardized effect sizes testing different hypotheses for individual species (circles) or meta-analyses of many species (triangles). Lines show 95% C.I.

*ggplot2* package

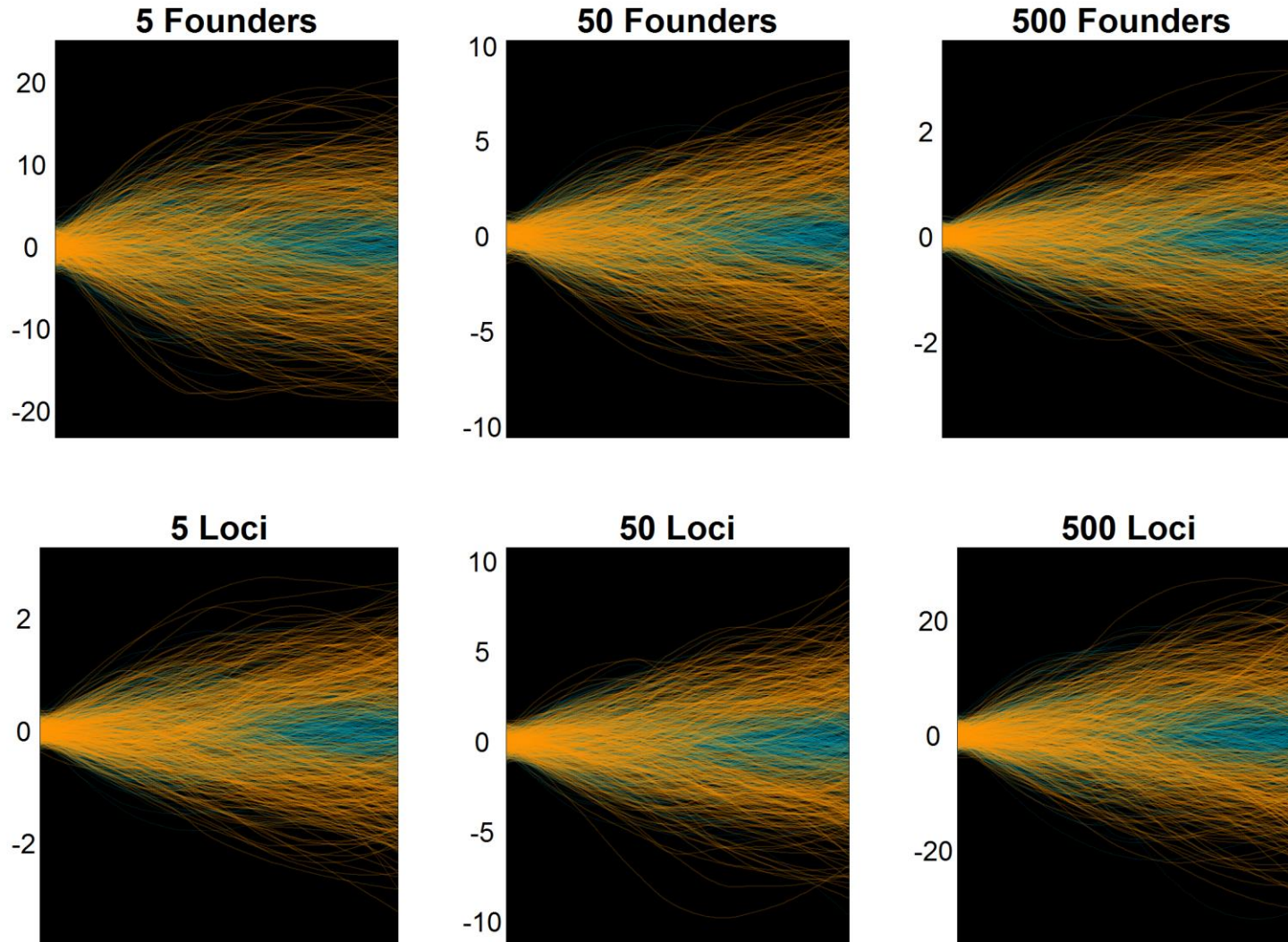
# Menagerie of graphics in R

Potpourri of graphs: (A) test of local adaptation; (B) fitness model; (C) selection splines



*ggplot2* package

## Stepwise colonization simulation model



*ggplot2* package

<http://www.davidmccandless.com/>

<http://colors.co/>

<https://color.adobe.com/>

<http://idl.cs.washington.edu/>

# Assignment: Make something beautiful

Investigate ggplot2() options at <http://docs.ggplot2.org/current/>

Use an R markdown file to create a clean, attractive 1-page report, focusing on a single visualization with ggplot(). The details of the report don't matter (e.g. real vs. simulated data).

Use custom formatting to make the most attractive report you can make using R markdown and ggplot().

You will be marked purely on (1) aesthetic (clean & clear, with no unnecessary 'ink'), (2) the application of methods used in Rmarkdown and ggplot(), and (3) clarity and readability of .Rmd code, and file knits without error.

Submit to [onq.queensu.ca](https://onq.queensu.ca) DropBox Link